Development of a Device Suitable for Naturalistic Studies of Passing Distances Between Cyclists and Vehicles

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Abstract

The Centre for Automotive Safety Research has designed a device intended for use in naturalistic studies of passing distances between cyclists and vehicles. Ten of these devices were built and deployed in a small trial to evaluate their effectiveness. This paper describes the device and its data collecting capabilities along with its performance during the trial. Performance was based on analysing objective data collected from the device as well as survey responses from the participants. Potential improvements to the design of the device and its implementation in naturalistic studies are suggested. Examples of the collected data are used to give an indication of the types of analysis that may be possible in a larger study.

Background

A commonly proposed solution to crashes between bicycles and vehicles is the implementation of a one metre passing law, which requires drivers to provide at least one metre of lateral distance between their vehicle and the cyclist's handlebars. However, it is not yet clear how a one metre passing law effects cyclist safety. Haworth & Schramm (2014) noted that there is limited knowledge regarding what affects the lateral distance at which a driver chooses to pass a cyclist and what effect the introduction of a one metre passing laws may have on this distance.

Several previous studies have investigated the distance at which bicycles are passed by vehicles (Walker, 2007; Parkin & Meyers, 2010; Love et al., 2012; Savolainen, Gates, Todd, Datta, & Morena, 2012; Chapman & Noyce, 2012; Chuang, Hsu, Lai, Doong, & Jeng, 2013; Walker, Gerrard, & Jowitt, 2014; Kay, Savolainen, Gates, & Datta, 2014). These studies have investigated how passing distance is altered by various factors. However, many of these studies utilised an instrumented bicycle that was ridden by only one (Walker, 2007; Chapman & Noyce, 2012; Walker et al., 2014) or just a few cyclists (Parkin & Meyers, 2010; Love et al., 2012; Chuang et al., 2013). Additionally, some studies restricted data collection to a specific set of streets or travel routes where cycling infrastructure details were collected beforehand (Parkin & Meyers, 2010; Love et al., 2012; Chapman & Noyce, 2012; Chuang et al., 2013; Walker et al., 2014).

Because of these limitations, the results of such studies cannot claim to be representative of the average riding experience or be used to make generalised predictions about passing events and crash risk. Naturalistic studies of vehicle-bicycle passing distances, in which cyclists ride their own bicycles and select their own routes, would provide results that were free from the bias of earlier studies and provide mass data for improved statistical analysis.

Device description

The Centre for Automotive Safety Research (CASR) has designed and built a cyclist passing device that is relatively small, lightweight and able to be easily attached to almost any bicycle (see Figure 1). The device is intended to be used in naturalistic studies where a cyclist rides their own bicycle and travels their usual routes.

The device is comprised of the following parts:

- Two ultrasonic sensors mounted at the front and rear (measures lateral distance to closest object)
- GPS sensor (measures cyclist location and speed)
- Microcontroller with data logger (records GPS and ultrasonic data to memory card)
- Battery

Figure 1. Passing device (circled in red) attached to a bicycle

Trial description

A small trial of the device was instigated to evaluate its suitability for naturalistic studies, assess how user friendly it is for volunteer cyclists, and determine what the full data collection capabilities may be.

Ten devices were built and attached to the private bicycles of volunteer cyclists for a period of two weeks. A survey of the volunteer cyclists was administered before and after the trial to assess their attitudes to one metre passing laws and gauge their acceptance of the device.

Discussion

Based on the data collected during the trial and the survey responses of the participants, several potential improvements to the design of the device and its implementation in naturalistic studies are suggested. Examples of the collected data indicate the device is likely to be a useful research tool in larger studies of passing distances between bicycles and vehicles.

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